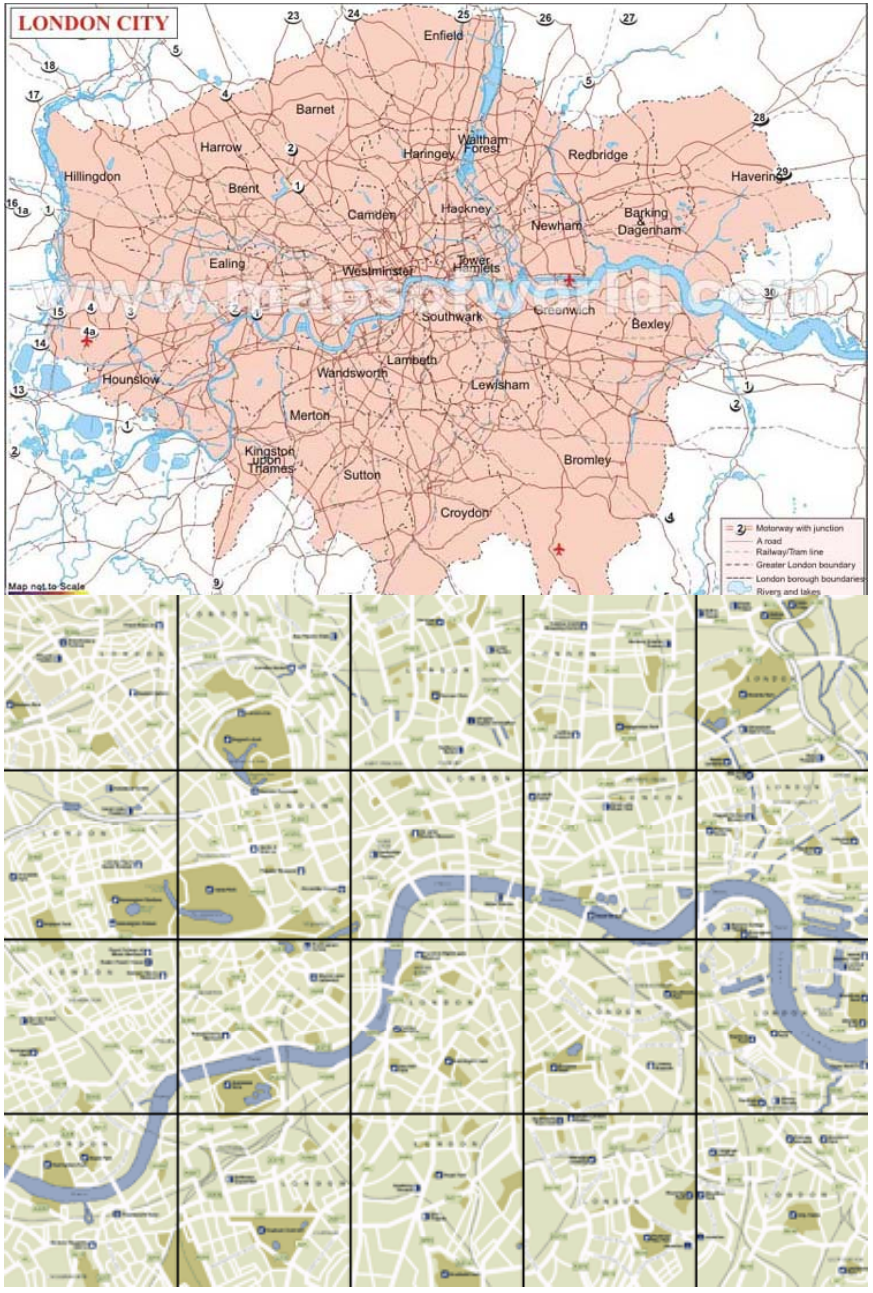
Taxi drivers' brains 'grow' on the job

Taxi drivers given brain scans had a larger hippocampus compared with other people, part of the hippocampus grew larger as the taxi drivers spent more time in the job



It can take 3 years for London cab drivers to get license

Navigation-related structural change in the hippocampi of taxi drivers

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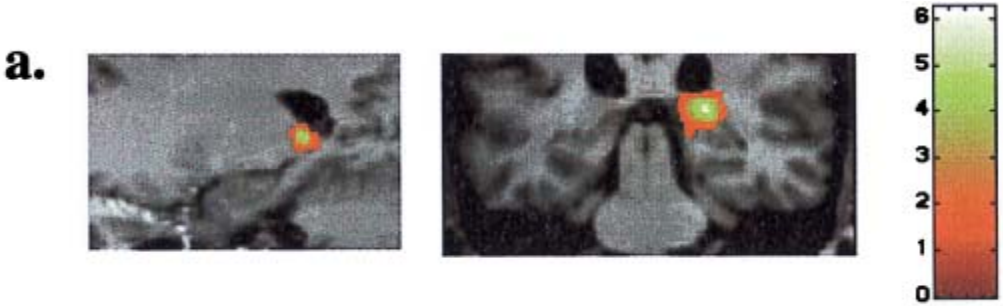
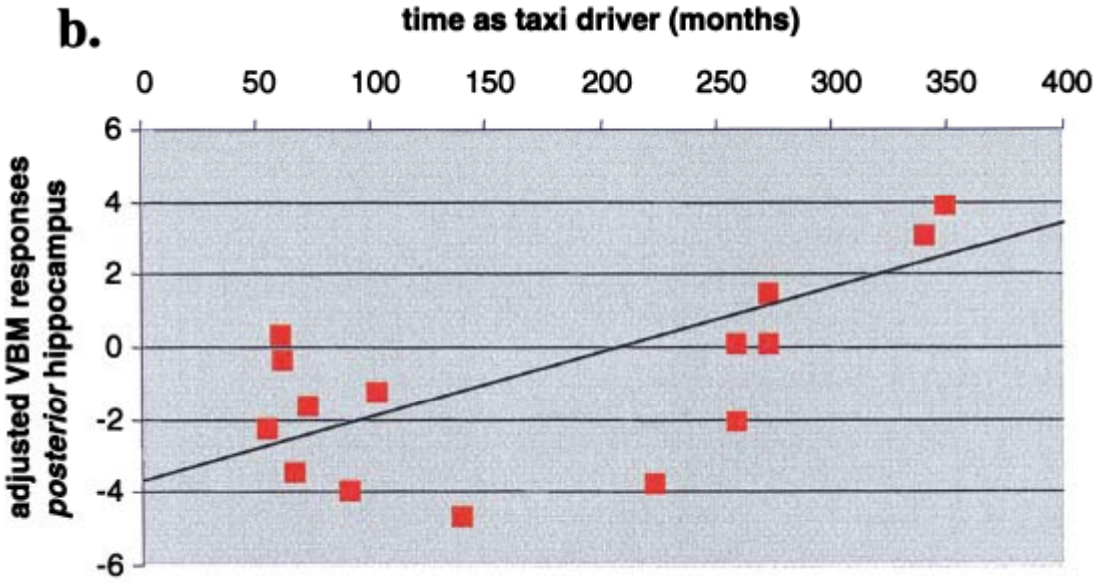
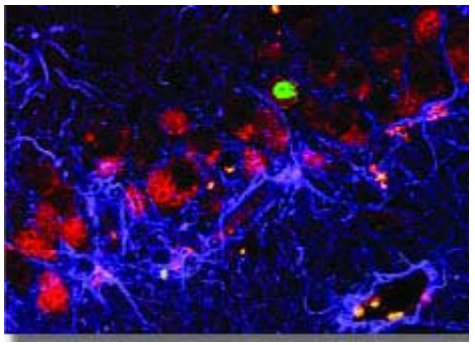




Scientists used to think human brains would not grow new neurons as adults.

But now we know we do grow new neurons as adults, and…

The more you use your brains, the more new neurons grow, and healthier you are.



Animals possess a remarkable array of strategies to forage

1. Pilfering and anti-pilfering (scrub jays)

2. Special perceptual system (for example, echolocation)

3. Information provided by foraging companion (honeybee workers)

4. Deceiving prey into approaching them

Honey bees: getting help from companions

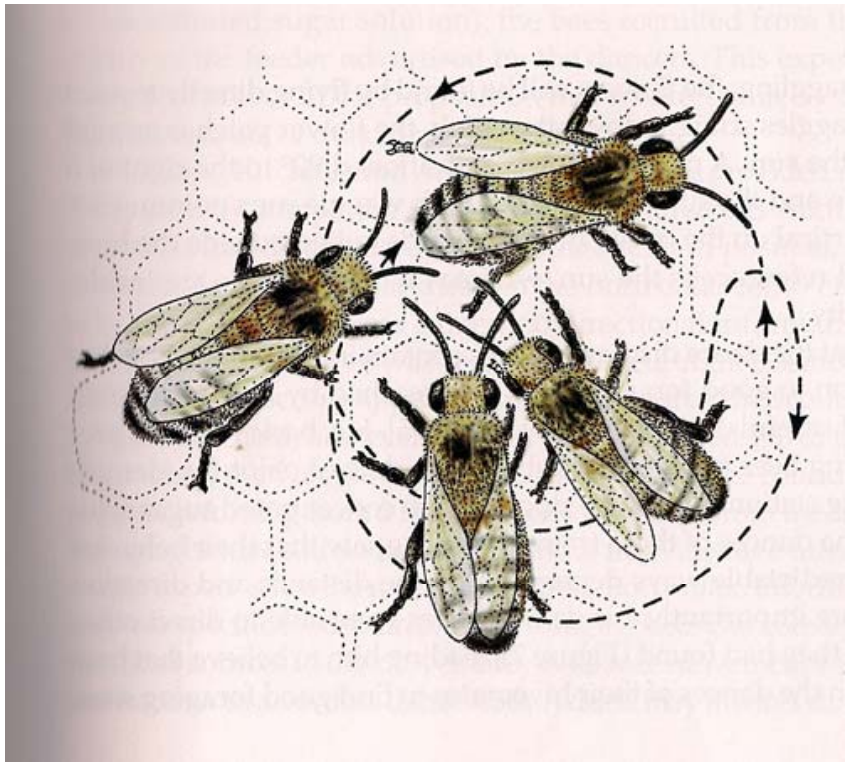
Foraging worker bees perform dance when they return to the hive after having found a good source of pollen or nectar.

Dances contain a lot of information abut the location of the food source.

Honey bee dance

1.Round dance

food source is <50 meters

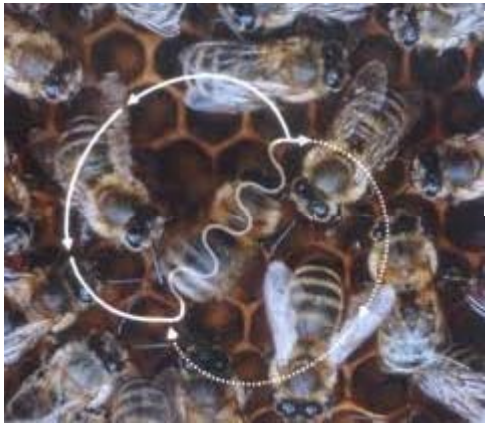


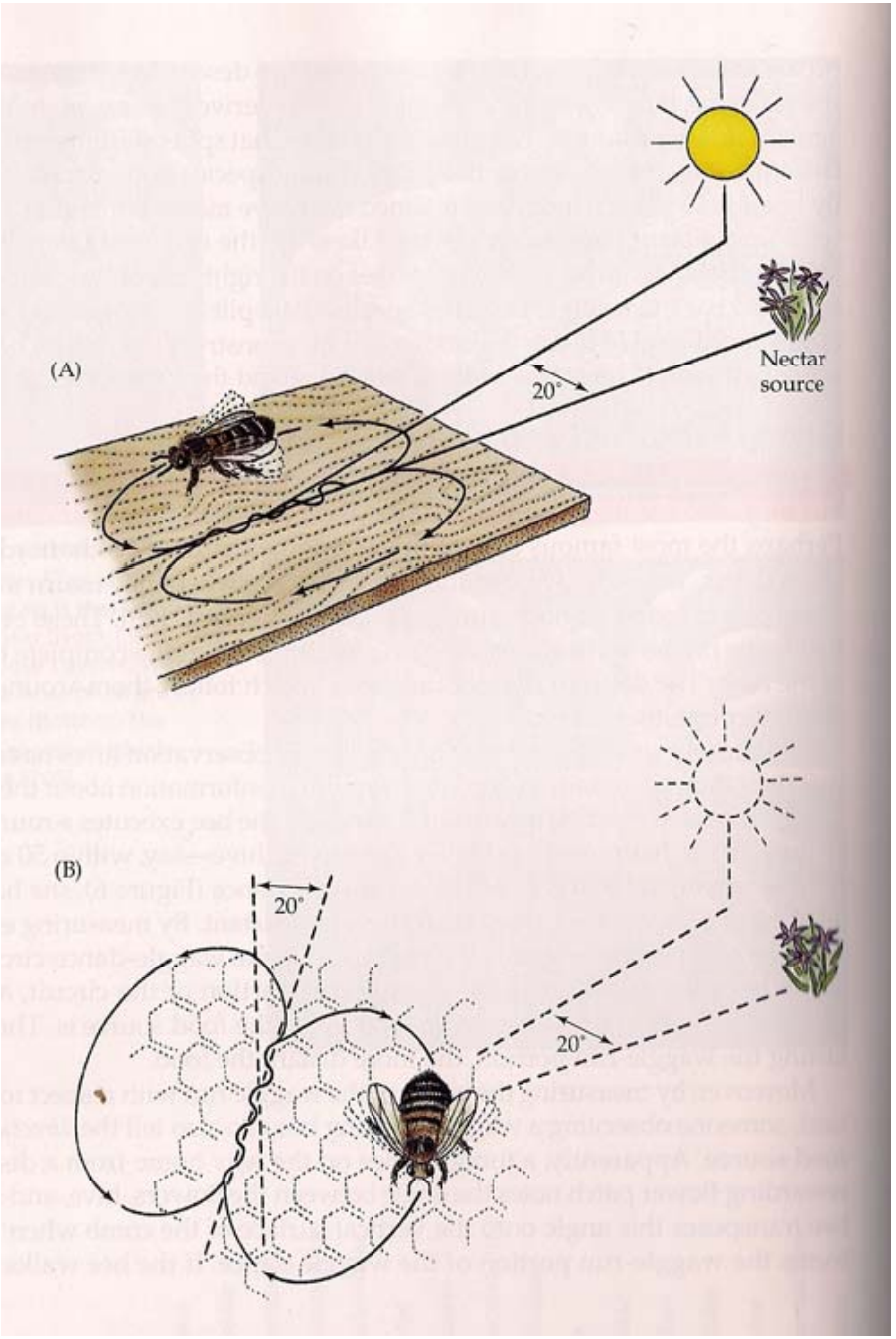
2. Waggle dance

food source is >50 meters

3. Angle of the dance:

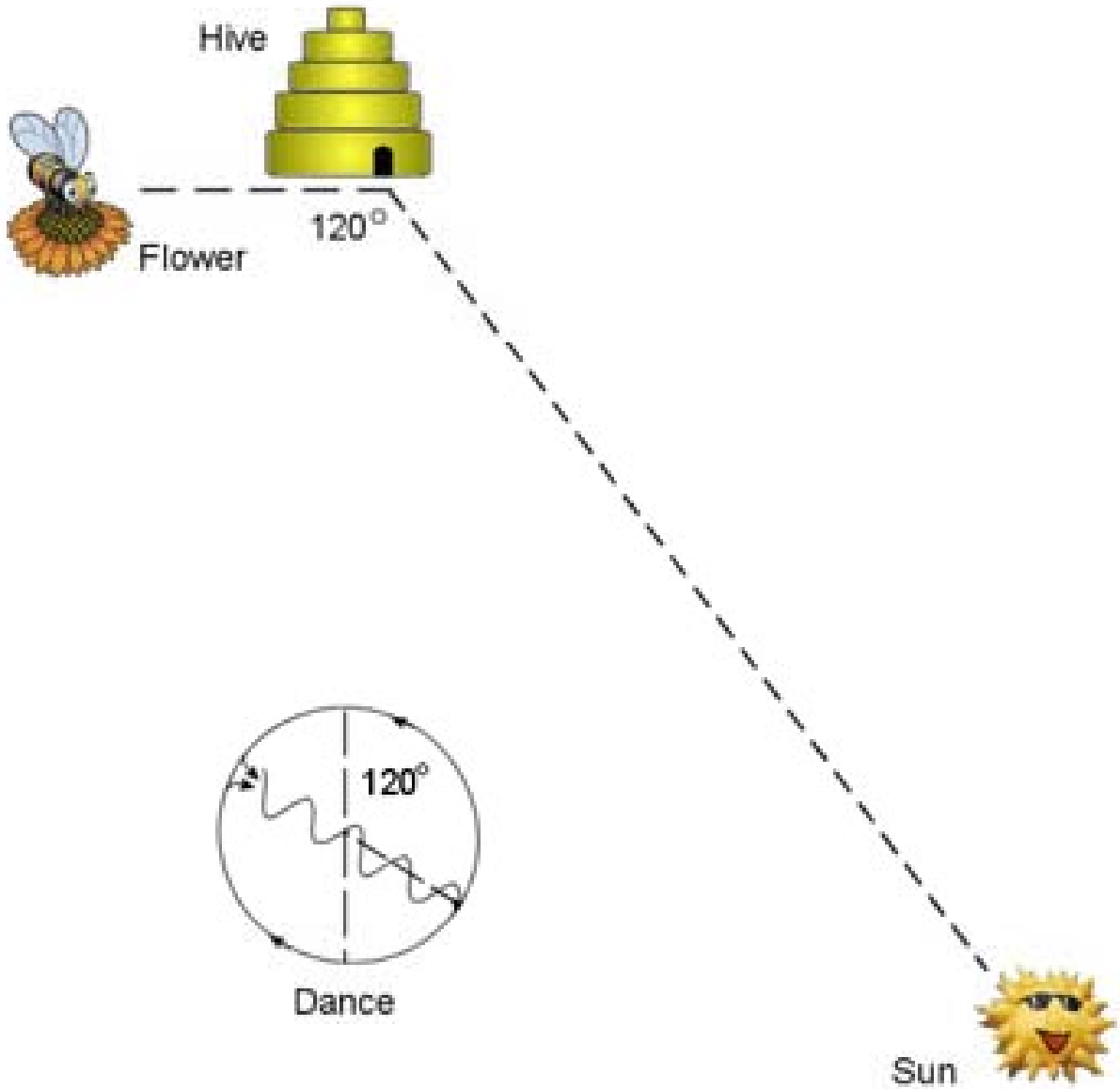
direction to the food source.





Waggle dance

The more circles the bee dances, the further the food source


Hive
120°
Flower
120°
Dance
Sun

Honeybee workers

(lifespan=1month)

1. Hatch ~ 2,3 weeks old:
   Nursing bees (sitters)

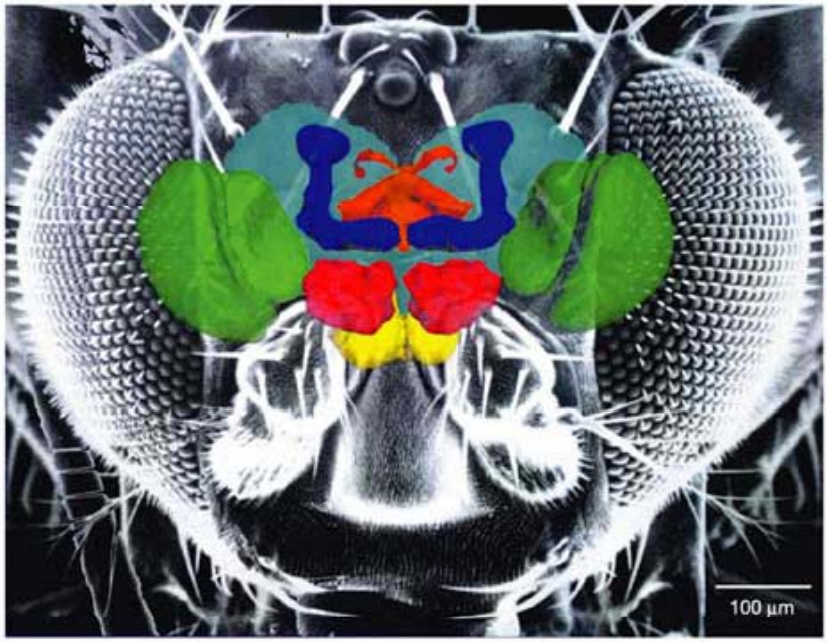
2. Then head out, become foragers

→ a brain area “mushroom bodies” grows

→ hormone (JH) increases

→ a gene *“for”* (foraging) turns on

Mushroom bodies and honeybee foraging



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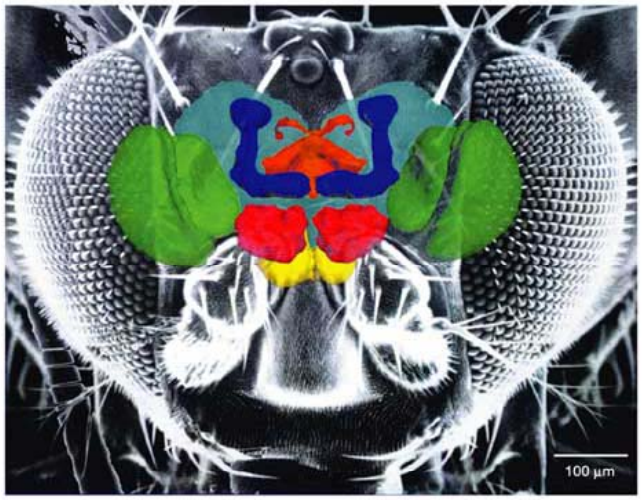
Mushroom bodies – spatial navigation and memory; its function is similar to the Hippocampus in vertebrates

Forager workers have significantly larger (15%) mushroom bodies than younger nursing bees that remained in a colony.

There is a correlation between Mushroom bodies size and honeybee foraging behavior



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Can we say Mushroom bodies grow in size (because of age) causes foraging behavior?

Or foraging behavior causes the size of Mushroom bodies increases?

How do you conduct an experiment to test the cause-effect?

Experimentally remove the mushroom bodies
Induce the foraging behavior in younger bees

2. Hormone mechanisms of honeybee foraging

Juvenile hormone (JH) is
responsible for honeybee foraging

As bees mature into foragers that leave the nest,
the level of JH significantly increases.

There is a correlation between *JH* hormone level and honeybee foraging behavior

Can we say higher *JH* hormone level causes foraging behavior?

Or foraging behavior causes the higher level of juvenile hormone?

How do you conduct an experiment to test the cause-effect?

Experimentally remove the gland that produces *JH.*
Induce the foraging behavior in younger bees

This gene "*for*" becomes active when bees grow from sitters to foragers:

Hypothesis 1: "*for*" has a role on foraging

Hypothesis 2: "*for*" is related to age, nothing to do with foraging.

How do you test these two hypotheses?

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Locating prey by deceit

17 Deception as an adaptive tactic for capturing prey. (Left) A juvenile female jumping spider (on the left) is plucking the web of an orb-weaving spider (on the right) in such a way as to mimic the signals of a prey item trapped in the web. When the orb-weaver comes closer, the deceptive predator will attack and kill the deceived prey. (Right) The bolas spider swings its lure, a ball impregnated with a scent identical to the sex pheromone of certain female moths. Male moths that approach the odor source are often captured by the sticky ball and then reeled in to be eaten. Photographs by (left) Robert Jackson, from Jackson and Wilcox [570] and (right) William G. Eberhard.

What to eat?

Optimal foraging theory

Foraging decisions should be optimal in the sense of maximizing the fitness of the decision maker (benefit/cost).

Animal should choose food items that contribute the most to their reproductive success. (ideally…)

Food selection by howler monkeys

(1) The more common a tree species, the less likely the monkeys were to feed on its leaves, they spent more time searching out the scarcer species.

(2) They preferred the scarcer, smaller new leaves to the more abundant, larger mature leaves

(3) The monkeys often ate only the petiole and dropped the larger leaf blade (wasteful?)

It turns out….

The most common tree species had leaves loaded with alkaloid poisons, or indigestible tannins.

Among the scarcer, preferred tree species, howlers sought out just those individuals with especially low levels of alkaloids and tannins.

New leaves contain more water, less nonnutritive fiber than mature leaves do.

Monkeys eat the leaf part (petiole), that is lowest in toxins while discarding the more poisonous leaf blade

What are they eating?

Red-and-green macaw

What are they eating?

Red-and-green macaws eat clay:

They feed on certain seeds, unripe fruits, leaves (high in toxins, alkaloid)

Clay → detoxification of toxins and alkaloid

Why do humans consume alcohol, spices?

Nutritive value is low, but we like it, what is the adaptive value?

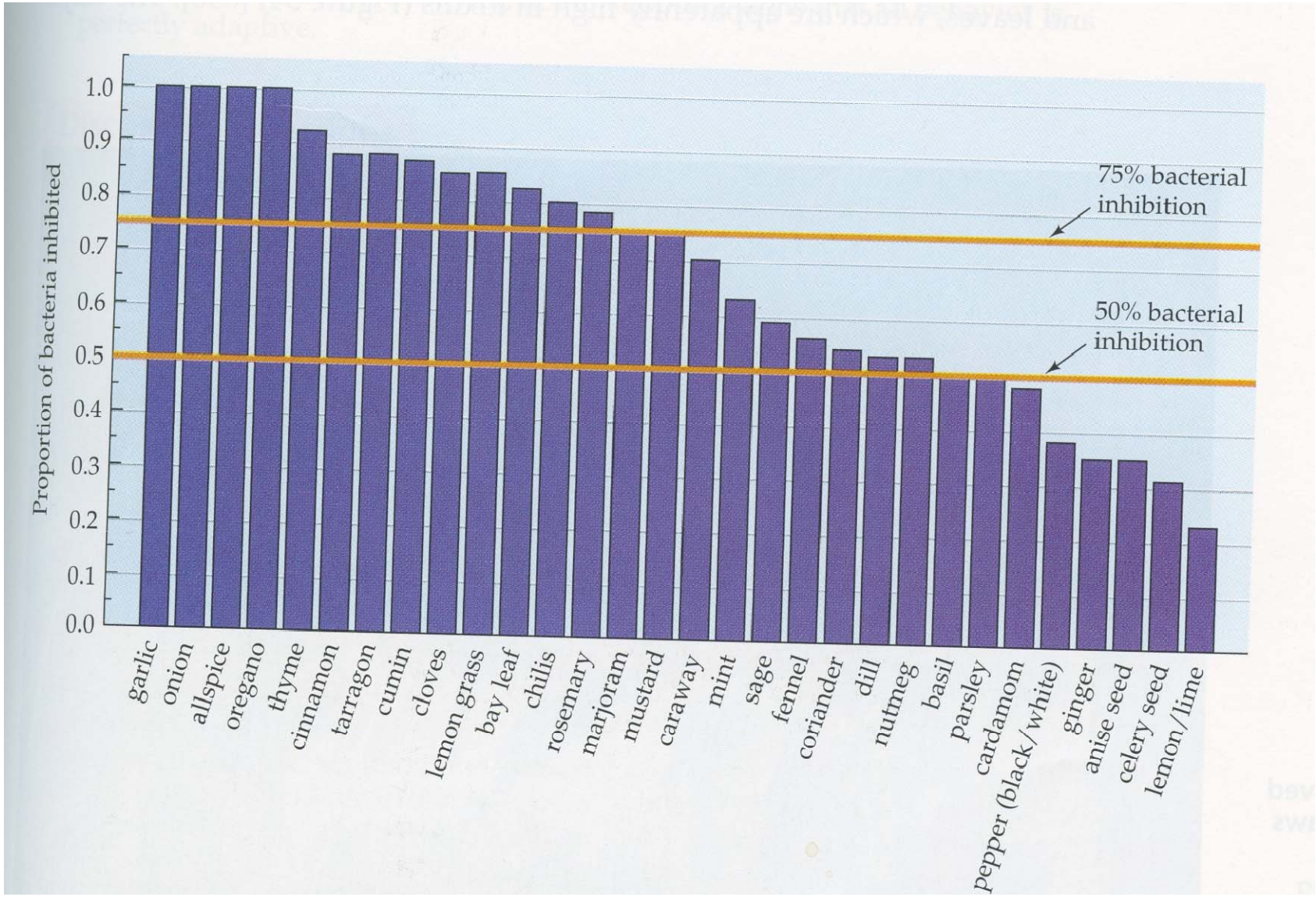
Why do humans consume alcohol? The origin?

Primates become drunk eating ripe fruits.

U.S. Fish and Wildlife

"…..occasionally a cedar waxwing will become drunk or even die from eating berries that have fermented….."

Spices vs. anti-bacteria



Talk of cannibalism

Jared M. Diamond

Incontrovertible evidence of cannibalism has been found at a 900-year-old site in the southwestern United States. Why do horrified critics deny that many societies have found cannibalism acceptable?

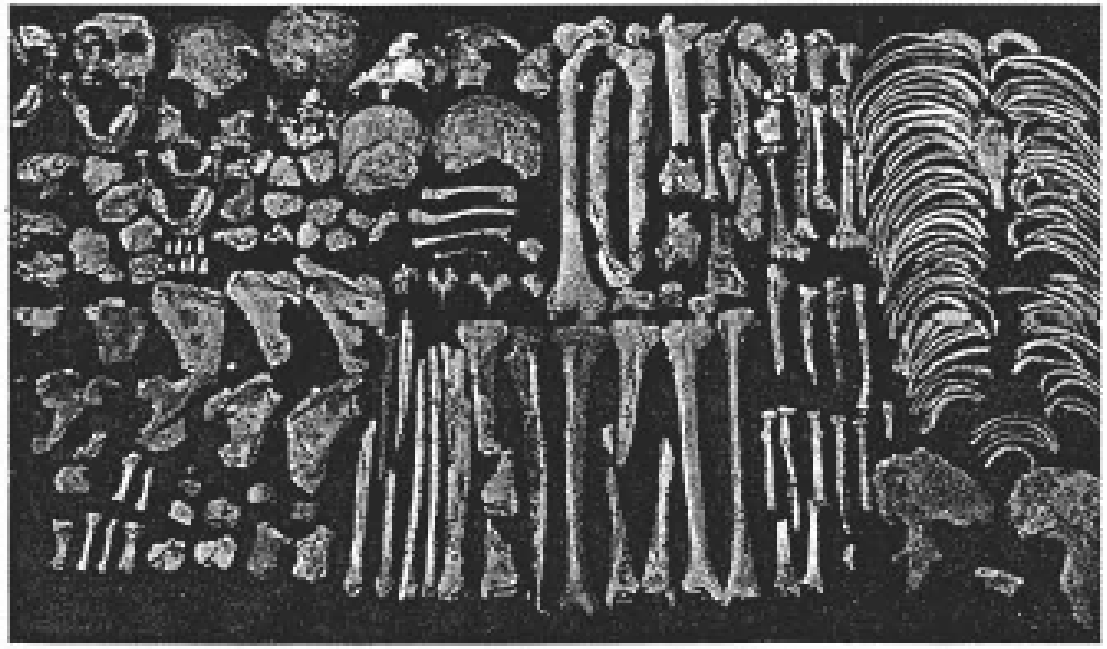


Figure 1 Evidence for the occurrence of cannibalism: the complete collection of human bones from Room 2 of the AD 1150–1200 Anasazi pueblo Houck K, in Arizona. Bones from at least four adults, two teenagers and one child were found. As at many other sites where cannibalism is thought to have occurred, vertebrae are largely missing (because they were crushed to extract marrow), and ends of bone fragments have a rubbed appearance (as a result of having been boiled in pots). Marlar *et al.*[1] have now found further evidence for cannibalism — the presence of human myoglobin protein in cooking pots and in human faeces from an AD 1150 Puebloan site in the southwestern United States. (Photograph reproduced from ref. 2.)

Questions for the quiz on Friday

1. why dogs are better animal models
   then chimps to study social intelligence?

2. Do dolphins have simple associative learning
   or do they have more complex and creative
   intelligence? How do you test it?

3. Octopus use its mimicry for what purpose?

4. What is special about Alex's (the parrot)
   intelligence?